ing and thickness of the clouds, and the slope of the lapse rate in the inversion layer. For any given surface temperature, T_c varies directly with (1) the thickness of the clouds and (2) the steepness of the slope of the lapse rate curve in the inversion layer, as can be seen from figure 5. However, without accurate information no attempt should be made to use this method. It should be pointed out also that the application of this method assumes that the specific humidity remains fairly constant during the clearing process.

This information may often be had from scheduled airline pilots, a very satisfactory source. Also nearby mountain stations can give this information, though in general, due to the fact that the elevation of the top of the clouds has to be estimated, the results therefrom are not always reliable. For example, an error of 500 feet in estimating the elevation of the top of the clouds will give a very unsatisfactory value for T_c. It is also often difficult to get an accurate concept of the lapse rate in the inversion layer; for the mountain station may be above the inversion layer, in which case this method cannot be used unless temperature readings are available from some other stations at an intermediate elevation. Also, early morning temperatures from such stations are invariably lower than the free air temperature of the same level. It has been found that early evening temperatures from such stations in the vicinity of Burbank, correspond well with the temperature at the same level on the airplane flight of the following morning from North Island.

Experience has further shown that this method may not be reliable when a ragged or variable ceiling prevails. Under such circumstances the thickness of the clouds cannot accurately be evaluated. Any other factor, such as a changing synoptic situation, which influences the thickness of the clouds will also make this method invalid, for T_c would then be a variable. The use of the surface temperature as as basis for computing T_c is apt to be unreliable in the case of comparatively high ceilings, especially if the clouds did not form until well after midnight. In such cases, temperature data should be available from the top or base of the cloud layer in order to compute T_c.

Some results are presented in table 1. It was decided to use for this purpose the results obtained during May and June of 1938, a period when daily morning radiometeorograph observations were made at Burbank, and hence a period during which no doubt can exist as to the reliability of the source of the data. Under the heading, T_c, is the indicated time of clearing, and under the headings, BRKN, and SCTD, the time at which the clouds first became broken and scattered respectively. While the results are by no means perfect, broken or scattered clouds were reported within 1 hour of the indicated clearing time in approximately 80 percent of the cases, and in all cases within 1½ hours of the indicated clearing time. We therefore believe these results justify the use of this method of forecasting the clearing of California summertime stratus clouds.

TABLE 1

Date	t_c	BRKN	SCTD
	a. m.	*a. m.*	*a. m.*
May 11	7:20		8:10
May 12	8:10		8:41
May 13	8:00	8:41	8:45
May 14	8:30	9:15	9:41
May 16	None		
June 2	8:40		7:29
June 3	8:35		8:25
June 6	8:35	9:00	9:10
June 7	10:55	11:29	11:34
June 15	8:35	9:00	9:04
June 16	8:30		9:55
June 17	10:40	11:00	11:10
June 23	8:00	8:29	8:41
June 24	8:30	9:41	9:50
June 25	9:00		9:09
June 27	7:30		8:06
June 28	10:10	8:15	9:50
June 30	11:40		12:55

REFERENCES

(1) E. H. Bowie. The Summer Nighttime Clouds of the Santa Clara Valley, California. MONTHLY WEATHER REVIEW, 1933, 61: 40–41.

(2) E. M. Vernon. The diurnal Variation in Ceiling Height Beneath Stratus Clouds. MONTHLY WEATHER REVIEW, January 1936.

(3) Dean Blake. Further Conclusions from Additional Observations in the Free Air over San Diego, Calif. MONTHLY WEATHER REVIEW, June 1934.

(4) Sverre Petterssen. On the Cause and Forecasting of the California Fog. Journal of the Aeronautical Sciences, July 1936.

(5) Irving P. Krick. Forecasting the Dissipation of Fog and Stratus Clouds. Journal of the Aeronautical Sciences, July 1937.

(6) Lt. Floyd B. Wood. The Formation and Dissipation of Stratus Clouds Beneath Turbulence Inversions. Abstract-Bulletin of the American Meteorological Society, March 1938.

BIBLIOGRAPHY

[RICHMOND T. ZOCH, in charge of library]

By AMY P. LESHER

(This section will be resumed in the March issue—Editor.)

SOLAR OBSERVATIONS

[Meteorological Research Division, EDGAR W. WOOLARD in charge]

SOLAR RADIATION OBSERVATIONS, OCTOBER 1939

By IRVING F. HAND

Measurements of solar radiant energy received at the surface of the earth are made at nine stations maintained by the Weather Bureau, and at ten cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Washington, D. C., Madison, Wis., Lincoln, Nebr.) and at the Blue Hill Observatory at Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau stations at Washington and Madison.

The geographic coordinates of the stations, and descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data, obtained up to the end of 1936, will be found in the MONTHLY WEATHER REVIEW, December 1937, vol. 65, pp. 415 to 441; further descriptions of instruments and methods are given in Weather Bureau Circular Q.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parentheses). At Madison and Lincoln the observations are made with the Marvin pyrheliometer; at Washington and Blue Hill they are obtained with a recording thermopile, checked by observations with a Marvin pyrheliometer at Washington and with a Smithsonian silver disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 7:30 a. m. and at 1:30 p. m. (75th meridian time).

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, then departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

Beginning with July 1939, data from Cambridge, Mass., have been included in table 2 through the courtesy of Dr. H. C. Hottel of the Massachusetts Institute of Technology. Radiation apparatus for the same type of measurements was installed at the Weather Bureau office in Albuquerque, N. Mex., in September 1939, and these data now also appear regularly in table 2.

Direct radiation intensities averaged close to normal at Madison and below normal at Washington and Lincoln. The data for Blue Hill will be published in the February Review.

Total solar and sky radiation was above normal at all stations except Fresno, Twin Falls, La Jolla, Riverside, and Newport.

No polarization observations were obtained at Madison owing to continual snow and ice cover.

TABLE 1.—*Solar radiation intensities during January, 1940*

[Gram-calories per minute per square centimeter of normal surface]

WASHINGTON, D. C.

Date	7:30 a.m. (75th mer. time)	Sun's zenith distance 78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p.m. (Local mean solar time)
		Air mass, A. M.					P. M.				
	e	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
Jan. 3	1.45				1.36						1.45
Jan. 9	1.28	0.72	0.92	1.10	1.32						1.88
Jan. 10	2.26				1.26						2.06
Jan. 16	1.78	.80	.88	.95	1.26						1.60
Jan. 22	1.52				1.51						1.52
Jan. 25	1.32	.59	.78								1.24
Jan. 26	1.02				1.25						.86
Means		.77	.86	1.02	1.33						
Departures		+.03	0	0	+.09						
MADISON, WIS.											
Jan. 5	0.74	.88	1.02	1.22		1.68		1.21			.96
Jan. 12	2.16			1.24							2.06
Jan. 17	.74		1.04			1.49					.81
Jan. 18	.23		.95	1.19		1.73		1.07			.46
Jan. 20	1.07	.84									1.52
Jan. 25	.53	.95	1.01	1.25		1.69		1.14			.91
Jan. 27	.86		1.06	1.19		1.60					1.32
Means		.89	1.02	1.22		1.64		1.14			
Departures		−.06	−.03	+.02		+.02		−.01			
LINCOLN, NEBR.											
Jan. 2	0.48		.78	1.11	1.50			1.32			1.12
Jan. 4	1.37	1.17	1.27	1.39					1.26	1.11	.79
Jan. 11	1.68								1.16		4.47
Jan. 16	2.06							1.03	.95	.83	1.88
Jan. 18	.25	1.17	1.26	1.37	1.54						.36
Jan. 19	.79	1.08	1.21	1.35	1.46						.87
Jan. 20	.56	1.02	1.22	1.36	1.51						1.19
Jan. 22	.43	.81	.86	1.04				1.17	1.05	.90	.86
Jan. 25	.36	1.09	1.22	1.35	1.51						.48
Jan. 26	.51	.96	1.13	1.34	1.54			1.38	1.23	1.13	.79
Jan. 27	.28	.74	1.16	1.10							.91
Jan. 29	1.32			1.31				1.30	1.20	1.07	2.62
Means		1.00	1.12	1.27	1.51			1.24	1.14	1.01	
Departures		+.07	+.07	+.07	+.11			+.05	+.09	+.08	

*Extrapolated.

TABLE 2.—*Average daily totals of solar radiation (direct+diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

Week beginning—	Washington	Madison	Lincoln	Chicago	New York	Fresno	Fairbanks	Twin Falls	La Jolla	Miami	New Orleans	Riverside	Blue Hill	Newport	Friday Harbor	Cambridge	Albuquerque
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Jan. 1	188	168	180	115	137	136	7	106	149	304	152	125	216	213	75	190	242
Jan. 8	125	91	164	54	57	159	14	103	206	305	240	176	136	138	90	109	294
Jan. 15	190	220	234	174	170	85	28	168	311	295	284	290	182	181	81	162	270
Jan. 22	245	214	286	179	191	122	13	128	246	387	244	229	227	227	74	200	370
DEPARTURES FROM WEEKLY NORMALS																	
Jan. 1	+19	+40	+5	+31	+31	−12	0	−46	−81	+5	−20	−136	+71	+65	+5		
Jan. 8	−24	−40	−18	−25	−48	−4	+4	−52	−51	+7	+34	−79	−17	+26	+13		
Jan. 15	+33	+66	+38	+75	+55	−96	+14	−4	+45	+8	+64	−20	+13	−8	+1		
Jan. 22	+66	+29	+54	+58	+38	+9	−13	−54	−48	+52	+41	−49	+31	+31	−5		
ACCUMULATED DEPARTURES ON JANUARY 28																	
	+658	+665	+553	+973	+532	−721	+35	−1,092	−945	+504	+833	−1,988	+686	−434	+98		